



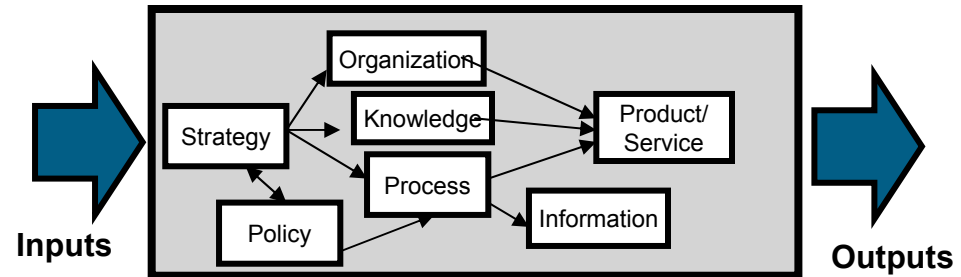
Modeling and Understanding Complex Enterprise Behavior using a Hybrid Simulation Approach

Presented By
Christopher Glazner
PhD Candidate
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Research Project Overview

Synopsis:

This research develops a methodology and supporting theory for modeling complex enterprise behaviors hybrid simulations based upon an enterprise's architecture.



An executable architecture model

Why:

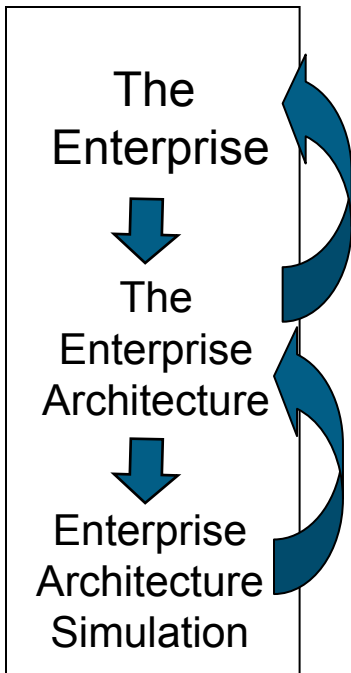
Such simulations can be used to find key levers across the enterprise to affect change and to evaluate future changes to the enterprise architecture

Hypothesis:

Hybrid modeling of an enterprise's *architecture* can allow a deeper understanding of enterprise dynamics arising from its structure and can identify key control levers and critical areas for alignment.

Method:

- Match modeling methodologies with views of the enterprise architecture based on the context of the view and the methodology.
- Simulate enterprise behavior arising from the enterprise architecture using hybrid (multi-agent, system dynamics, event-based) modeling techniques.
- Combine sub-models into an integrated hybrid model of enterprise behavior



Case Study: An Application of Enterprise Architecture-Based Simulation Modeling



■ *“TechSys”*

- *2 Billion dollar multi-market “enterprise of enterprises” in the aerospace/defense sector*
- *2004: New strategy developed to grow the enterprise in the future*
- *2005: New organizational structures put in place to support strategy*
- *2006: Work begun on developing new processes to support strategy*
- *2007: Doubled in size through a combination of internal growth and two major acquisitions that complemented strategy*
- *2008: “Do we have the right enterprise architecture to support our strategy?”*

Key Questions for TechSys

Area of Focus:

- TechSys's pursuit and capture of new business

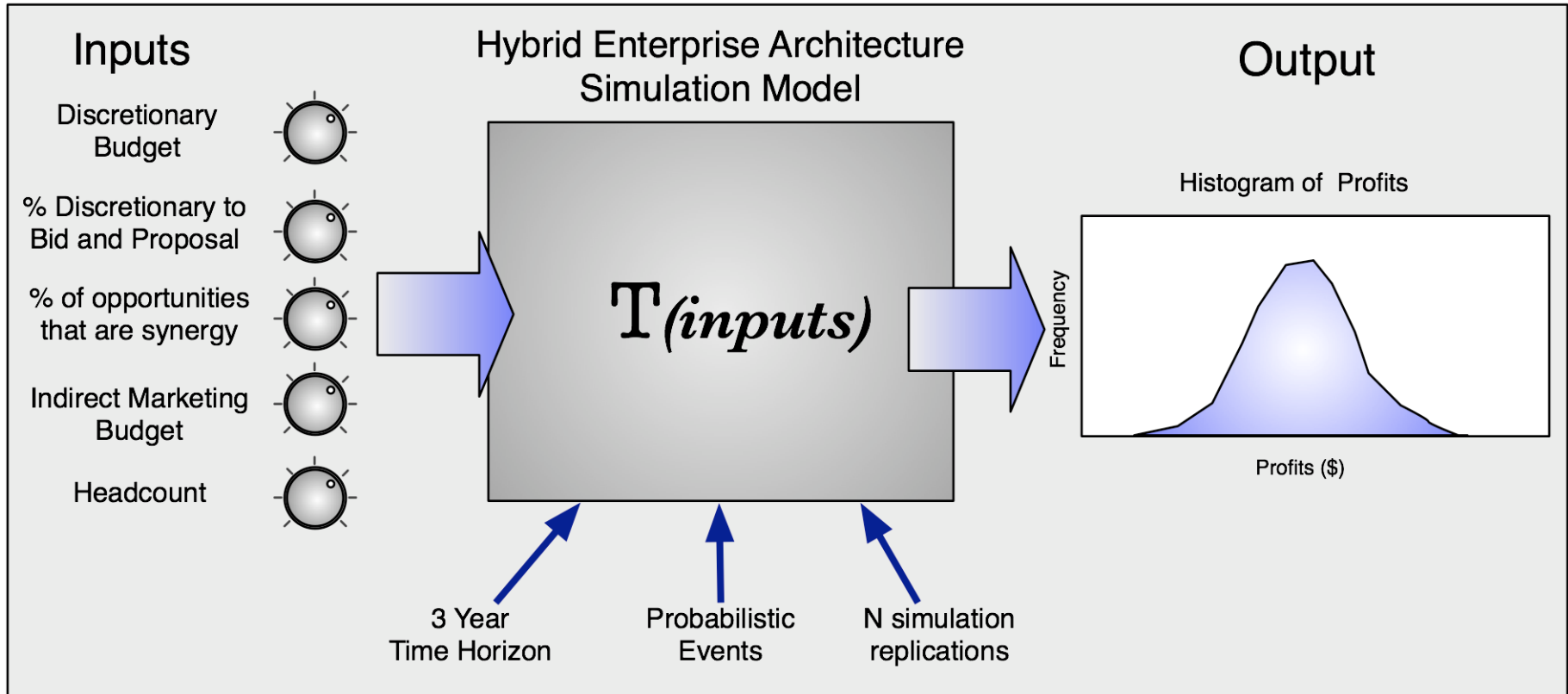
Key Questions:

- Can TechSys achieve its growth goals given its current enterprise architecture with constrained resources available for growth?
- How does the enterprise perform as resource allocations are changed? Does the architecture favor a particular business model?
- What changes can be made to the enterprise architecture to improve opportunities for growth given resource constraints?



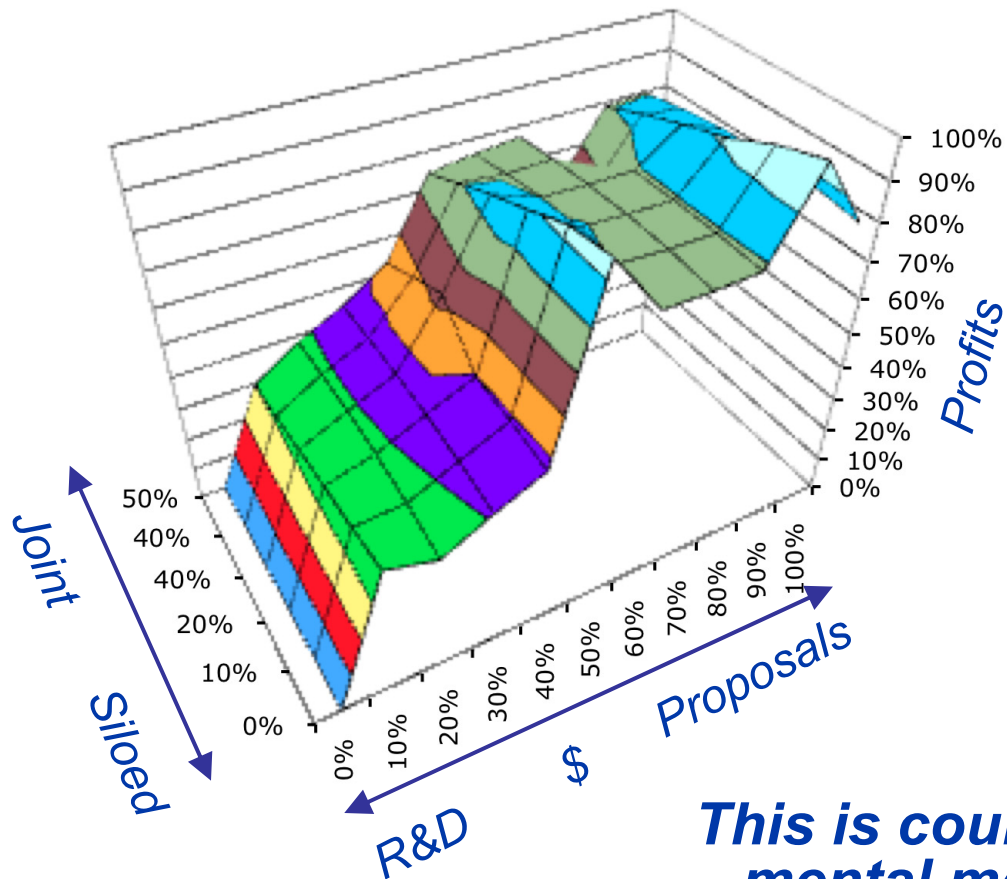
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High-Level Conceptualization



The model is run several hundred times in a Monte Carlo fashion for each combination of inputs to obtain a distribution for expected profits over a three year period

The Performance Landscape for the current Enterprise Architecture



Performance is best when :

1. the operating units do not pursue joint projects, and
2. the majority of discretionary funds is given to pursuing new proposals, rather than R&D

This is counter to the prevailing mental models and does not support TechSys's strategy!

Analysis of Enterprise Behavior

These surprising results in the model can be traced back to two major areas within the enterprise architecture:

- 1. The process used for funding new proposals between Operating Units (OUs) is biased against joint proposals;**
- 2. Profits arising from joint proposals are not shared equally between OUs, causing an additional bias against selecting them**

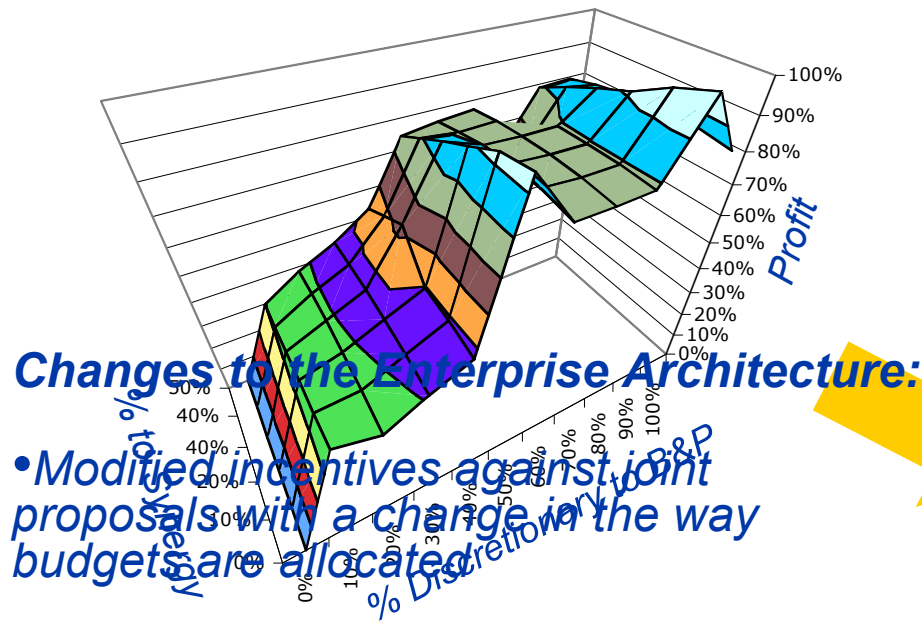
These two factors appear to have a multiplicative effect

The strong bias toward investing discretionary dollars towards pursuing new proposals can be attributed to:

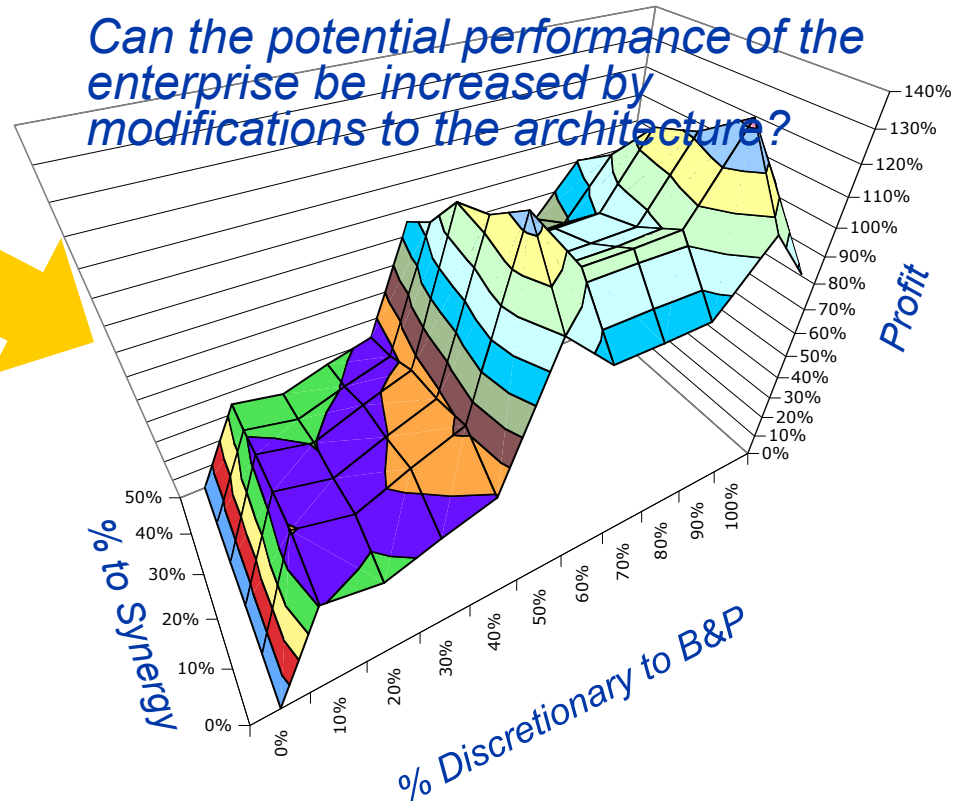
- 1. The time horizon for the model may be too short to realize benefits of R&D;**
- 2. TechSys is not getting a good return on its R&D investment**

An Alternative Enterprise Architecture: What If Analysis

Alternative Enterprise Architecture Performance Landscape



Can the potential performance of the enterprise be increased by modifications to the architecture?



Summary of TechSys Model

The simulation was able to:

- **Evaluate TechSys's architecture from a systems perspective**
 - Key dynamics were generated from the interaction of process, knowledge and organization views of the architecture
 - No other currently used modeling approach could have given similar results
- **Clearly show that the current architecture would not support their growth strategy**
- **Suggest changes for an alternative architecture that was capable of meeting growth goals**
- **Indicate that TechSys needs to evaluate its discretionary budget allocation strategy--it can clearly do better**
 - IRAD effectiveness also needs to be addressed. Perhaps develop a new process for selecting and funding IRADs.
- **highlight unanticipated benefits owing to the process of model development**

There is great potential for this model to be further developed.

Observations and Future Work

- This is the only known approach to enterprise architecture modeling that can analyze an enterprise architecture from a systems perspective and capture behaviors resulting from interactions across the views
- The EA Framework provided tremendous guidance in structuring the model, identifying data sources, and testing the model for completeness
- This approach can be coupled with a specific EA framework for fuller development into a standardized toolkit
- Libraries of architectures can be developed in a “toolbox” fashion that could make future models easier to develop.
- Modeling would be made easier if EA frameworks could include lists of common interfaces between views